EE/CpE 180

Spring 2001

Child Locator
Proposal

Team 20: Child Locator

Budget Total: $ 775

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April 23, 2001

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Introduction

A common fear among all parents is that of becoming separated from their child in a large public place. Parents lack the ability to be aware of the whereabouts of their child or children at all times. A stand-alone solution to this problem does not exist. A stand-alone solution is one that does not rely on an intermediary party such as an internet service provider or phone service provider. Children are particularly at risk of becoming lost or abducted in amusement or theme parks, ski resorts, state or national parks and forests, water parks, and so on. To reduce this risk, a system must provide parents with the real-time location of their child/children, relative to the parent's own location.

All current attempts of such a system design fall short of effectiveness and practicality. Though only a few such products exist, most offer a range in the order of feet rather than miles and are unable to provide an accurate assessment of the child's relative location in terms of distance and direction. The Fisher-Price Child Locator's (see Appendix D: References) mode of locating a lost or missing child consists of following a beeping sound emitted by the child's device. In an even fairly noisy environment, this device would be rendered useless. Another product, the Wherify Wireless Inc. Personal Location System (see Appendix D: References), uses GPS (Global Positioning System) and PCS (Public Communication System) to establish the position of the child. Though accurate, this device is costly and requires that a parent dial a phone number in order to obtain the location of the child or children. Obviously, this design lacks the ability to provide continuous, real-time information concerning the location of the child/children.

In light of the inadequacy of all existing versions of the "child locator", a better design is in order. All evidence indicates that the need exists for a new and effective "child

locator" system. To account for the shortcomings of the currently available products, the new design would feature a "personal" child locator system, or one that is portable, user friendly, accurate over a reasonable range of operation, and capable of providing real-time information regarding the relative position of a child or children.

Design Objectives

Design Goals & Constraints: Description and User Interaction

Typical Scenario

Early in the morning a family arrives at an amusement park ready for a day of fun and entertainment. At the gate they are given the option of renting a system with which the parents will be able to continuously monitor the relative location of their children. Having two fun-loving children, the parents opt to rent a parent device and two child devices. Upon rental, a child device is locked around the wrist of each of the two children and activated. A member of the park staff is then responsible for:

- Ensuring that the parent device is communicating with all child devices in use.
- Ensuring proper function of the parent device's display.
- Properly charged batteries.
- Evaluating the validity of the displayed relative positions of all children.
- Demonstrating all alarms.
- Explaining how to operate the system.

Once equipped and instructed, the parents are free to enjoy their day with the insurance of continuously knowing the whereabouts of their children.

Description

In order to be a personal device, the "child locator" must rely only on the actions and/or responses of the parent and child (not on an intermediary party). The personal child locator system will be comprised of one parent device and a maximum of four child devices. The parent and child devices will be capable of communicating within a range of up to 0.5 miles outdoors. Each system will be assigned a unique serial number. In the event that a replacement component is necessary, a user must provide the manufacturer with the serial number and the description of the device to be replaced (child or parent). The sole market for this device is as a rental unit in large, outdoor, public places, such as amusement or theme parks, state or national forests and parks, ski resorts, and so on.

Child Device

With his/her device, a child is capable of engaging its own panic button, whose state is indicated by an LED (Light Emitting Diode). Once pressed, the child's panic button causes the parent's audio alarm to sound for at least ten seconds. Along with this alarm, the parent will have a visual indicator, showing which child has pressed their panic button. After the ten-second period has expired, the child may disengage its panic button, resulting in the termination of the parent's audio alarm. The child device, itself, will be equipped with an audio alarm that sounds under any of three conditions:

1) The parent device panic button has been engaged.
2) The child has passed beyond the predetermined limit (~2500 ft.).
3) The child device has lost communication with the parent.

In the first case, when the parent's panic (call) button has been pressed, the child's alarm will continue to sound until the button has been disengaged. For this case, the child is incapable of turning off the alarm. In the second case, if a child passes beyond the 0.5-

mile range of the parent, the child's alarm will continue to sound until the child is back inside the half-mile radius. The third case is similar to the second. If the child device loses communication with the parent device, the child's alarm will continue to sound until the communication link between the two devices has been reacquired. The type of alarm, panic or out-of-range/communication loss, will be communicated to the child through two LED's. A red LED labeled "Panic" indicates a panic alarm, and a green LED labeled "Out-of-Range/Communication Loss" indicates that the device has either passed out of the 0.5-mile range or has lost communication with the parent device. To assure the child's understanding, each LED indicator label will be accompanied by a symbol or picture representing its alarm type (panic or out-of-range/communication loss).

Parent Device

The primary function is to display the relative location of one to four child devices. This relative location will be in the form of distance and direction from the parent to the child. The unit will display the following information for each child:

- Child number (1 - 4)
- Distance (in feet)
- A directional arrow
- State of child's panic button (engaged or disengaged)
- Out-of-Range/Loss of Communication status

The parent device will feature a panic button that, when engaged, causes all child alarms to sound until the button is disengaged. The state of the parent's panic button is indicated through the use of an LED. The parent device will also be equipped with an audio alarm that sounds under any of three conditions:

1) The child device panic button has been engaged.
2) The child has passed out of the 0.5-mile range.
3) The child device has lost communication with the parent.

If the child device panic button has been pressed, the parent alarm will sound for at least ten second, and thereafter will continue to sound until the child's panic button has been disengaged. If the child passes out of range of the parent, the parent alarm will sound until the child has passed back inside of the 0.5-mile range. Similarly, if the child loses communication with the parent, the parent's alarm will sound until the communication link has been reestablished. Furthermore, the parent device will be equipped with four "child selector switches". These switches allow the parent to select which child units are in use. Lastly, the parent device will feature a "low battery" indicator. This indicator will be in the form of an LED that lights up when the battery power falls below a certain level.

Sketch: Operation

Figure 1: Sketch of Operation

Sketch: Parent Device

Figure 2: Sketch of Parent Device

Sketch: Child Device

Figure 3: Sketch of Child Device

Performance Specifications

FUNCTIONS…….…	Distance (feet) Direction (arrow indicator) Panic Alarm Out of Range Alarm
RANGE……	0 - 0.5 miles
ACCURACY……..…	Distance: +/- 20 feet Direction: +/- 11.25°
FREQUENCY OF OPERATION……	2.4 GHz.
MAXIMUM NUMBER OF CHILDREN…	4
DISPLAY……	Liquid Crystal Display (LCD), 4 lines, 12 characters
DISPLAY REFRESH RATE……..…	5 seconds
DIMENSIONS……	Parent: 6" H X 4" W X 2" D Child: 3" H X 1.5" W X 1" D
WEIGHT……	Parent: 8 ounces Child: 4 ounces
POWER REQUIREMENTS……	Parent: 1000 mAh for 8 hrs. of operation Child: 800 mAh for 8 hrs. of operation
BATTERY LIFE……	8-12 hours
INITIAL ACQUISITION TIME……	max: 90 seconds min: 15 seconds
REACQUISITION TIME……	5 seconds
OPERATING ENVIRONMENT……	Outdoors
OPERATING TEMPERATURE……	0°C - 70°C
METHOD OF CONSTRUCTION…….	Printed circuit board
PROGRAMMING LANGUAGE……	C and Assembly

Deliverables and Validation

Deliverables

1. One (1) Parent Device
2. One (1) Child Device
3. Batteries (8 AA NiCad)
4. User's Manual
5. Service Manual

Validation

Test 1: Normal Operation

For this test, both the parent and child device will be operating outside with the child device approximately 1000 feet from the parent device.

In order to pass, the parent device must accurately display the direction and distance to the child device.

Test 2: Close Range Operation

For this test, both the parent and child device will be operating outside with the child device less than 100 feet from the parent.

In order to pass this test, the parent must accurately display the direction and distance to the child device.

Test 3: Long Range Operation

For this test, both the parent and the child device will be operating outside with the child device approximately 2500 feet from the parent.

In order to pass this test, the parent must accurately display the distance and direction to the child. If environmental factors reduce the maximum communication distance, the parent device must notify the user that the child is out of range, and the child device must notify the child that he/she is out of range.

Test 4: Parent Inside

For this test, the parent will first obtain its current location while outside before entering a building. The parent device will then be taken to a place inside the building where it can not determine its location. The child device will be operating outside at a range of 100 feet from the building.

In order to pass this test, the parent unit must accurately display the distance to the child from the parent's last known position and the direction to the child from it's current position.

Test 5: Child Inside

For this test, the child will first obtain its current location while outside before entering a building. The child device will then be taken to a place inside the building where it can not determine its location. The parent device will be operating outside at a range of 100 feet from the building.

In order to pass this test, the parent unit must accurately display the distance and direction to the child from child's last known position.

Test 6: Parent and Child Inside Different Buildings

For this test, the parent and child devices will first obtain their current locations while outside before entering two separate buildings. The parent and child devices will then be taken to a place inside the buildings where they can not determine their location. The buildings will be approximately 100 feet apart.

In order to pass this test, the parent must accurately display the distance and direction from the parent's last known position to the child's last known position.

Test 7: Child Out of Range

For this test, the child device will be a distance greater than 2500 feet from the parent device. Both the parent and the child device will be operating outside in normal conditions.

In order to pass this test, the audio alarm in the child device must sound, and a LED must signify that the alarm is because the child is out of range or communication has been lost. The child's alarm must sound until the child device is back in range and communication has been reestablished. The parent's audio alarm must also sound until the child is back in range and communication has been reestablished. Also, the parent's device must indicate which child is out of range.

Test 8: Parent Panic

For this test, both the parent and the child device will be operating outside in normal conditions. The child device will be approximately 1000 feet from the parent device when the panic button on the parent device is pressed. Once the child alarm is activated, the parent device will be switch back to normal operation.

In order to pass this test, the child's audio alarm must sound and a LED must signify that it is a panic alarm. The alarm must continue to sound until the panic button on the parent device has been disengaged. The parent device must display that the panic button has been pressed through the use of a LED. The LED must remain on until the panic button has been disengaged.

Test 9: Durability

Drop both units, one at a time, from two meters vertically so that they will land on one edge.

In order to pass this test, the devices must remain intact.

System Description

Parent Hardware Description

The parental device functional block diagram is shown in Figure 4. This block diagram shows the progressive expansion of detail that has been developed regarding the parental device. This figure shows several functional blocks, which make up the entire system of the parental unit. The parental unit is the primary component of the design. The parental unit is used to determine the distance and direction to one to four child units.

- *Antenna and Transceiver*: These blocks work together to form the communication link between the parental unit and the child unit. Transmission between the parent and child units is comprised of a request sent by the parent for "current location" data of the child. In response, the child unit transmits its current location.

- *UART*: The information received from the child travels along a serial link through the UART to form a eight-bit bus. This data then travels into the first of three software components.

- *Panic Button*: This block represents a button that the parent can push to engage or disengage. The panic request travels into the software where the panic state is analyzed. The panic state is then stored and transmitted along with the next poll-children request.

- *Number of Children*: This block is used for the parent to enter the number of children at the start-up or to change the number of children during operation of the parental device.

- *GPS receiver*: This block receives a RF (radio frequency) signal, which it analyzes in order to determine it's own location and the current time of day. This data determined by the GPS unit will be sent serially through the UART and stored by a software component.

- *Bus-Switch*: This block will determine if the data entering the UART is communicating with the transceiver or the GPS unit.

- *Coordinate Manipulation*: This block will first check the child selector switch to determine the number of children. This block will then start polling the children through the transceiver. It will gather and store both the parent and child GPS coordinates.

- *Panics or Alarms*: This block will check the data that was received from the child through the transceiver for the child's panic state. A child's panic state is considered "on" under any of two conditions: if the child is out of range of the parent and/or if the child has pressed their own panic button.

- *Distance and Direction*: This block uses the coordinates of the parent and child(ren) that was previously stored to determine the distance to the child unit from the parent and the relative direction to the child unit compared to that of the parent unit. This block also puts the information that is calculates into a display format compatible to that of the display block.

- *Display*: This block contains a display for the parent, which shows the distance and direction to the child(ren).

- *Audio Alarm*: This block contains an of alarm to notify the parent that a child is in a panic state.

- *10 second Timer*: This block is a timer to inform the parent when to stop waiting for a child to send it's requested information. The timer receives a one-second pulse from the GPS unit to synchronize the timer. At the end of ten seconds, the timer resets and starts counting again.

- *Low Battery Circuit*: This block will send a signal to the Low Battery LED block if the battery in the parent unit is getting low.

- *Low Battery LED*: This block contains an LED that will turn on when it receives a signal from the Low Battery Circuit block.

- *Parent Panic LED*: This block contains an LED that will turn on when it receives a signal from the PIC. The only time it will receive a signal from the PIC is when the parent presses the panic button on the parent device. It will only turn off when the panic button is pressed again.

- *Digital Compass*: This block contains a compass, which will constantly provide the direction the parent is facing.

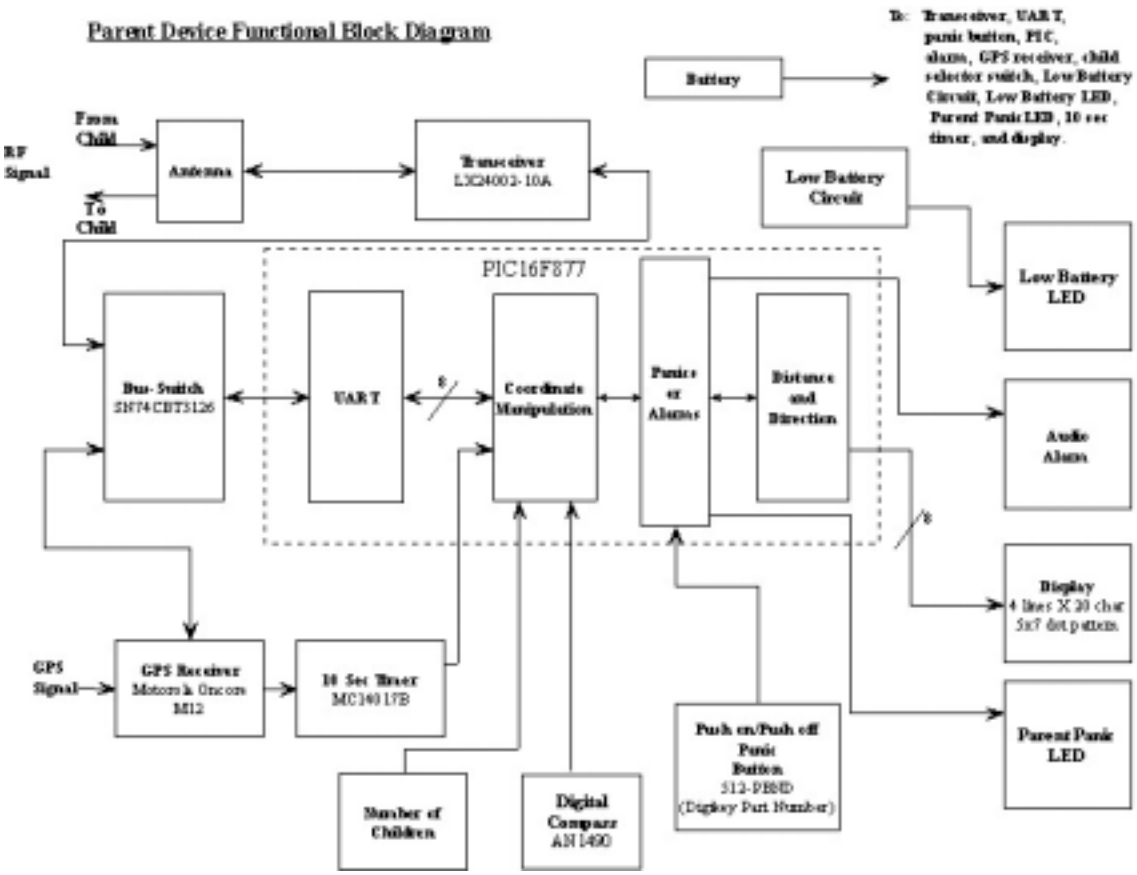

Figure 4: Parent Block Diagram

Child Hardware Description

The child unit is represented by the block diagram shown in Figure 5. This diagram displays all major components along with their connections, inputs, and outputs. The child unit is a secondary device that will determine it's current location and transmit it to the parent upon request.

All blocks except the software components have the same description as given for the parent block diagram. The first software component is responsible for determining when to send it's current location and panic state to the parent device. It also stores it location data received from the GPS.

- *Time and Coordinates*: This block first gathers the child's current GPS coordinates. Next, the block determines if the current time is the correct time for the child to send the recently gathered coordinates to the parent.

- *Panic LED*: This block checks the "panics or alarms" functional block to see if any panics-requests have been sent. If, in fact, a panic-request has been sent, the LED will turn on.

- *Out of Range LED*: This block checks the out-of-range bit in the data received from the parent. If the bit is set (value = 1), the LED will turn on. The LED will only turn off when it is determined that the child is no longer outside the range of the parent's device.

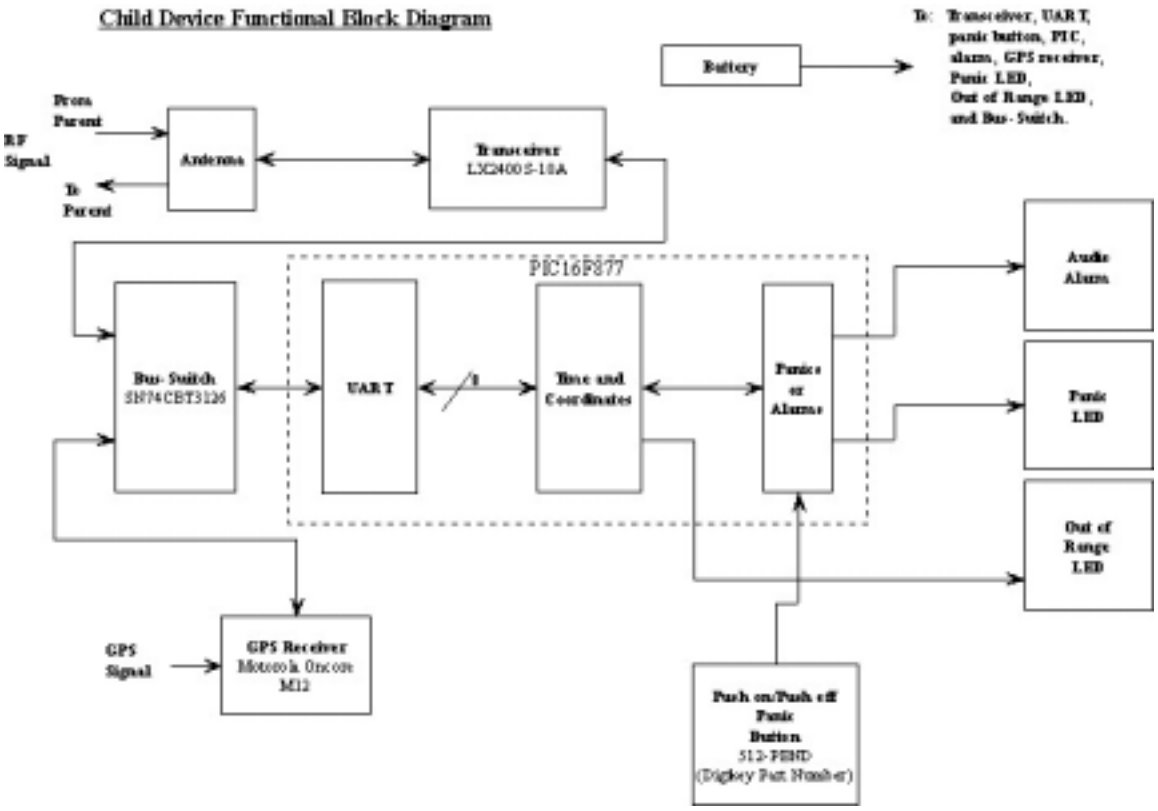

Figure 5: Child Block Diagram

Parent Device Software Description

Each parent device is responsible for controlling the out of range alarm and the panic alarm sent to its child units. In order to control the two alarms, the parent unit creates a 3-byte digital signal that is sent to all of its child units during transmission (See Appendix C). Within this transmission there are control bits for the two different child alarms. When the flow chart makes a reference to setting "child out of range" bit or alarm bit, these control bits are set.

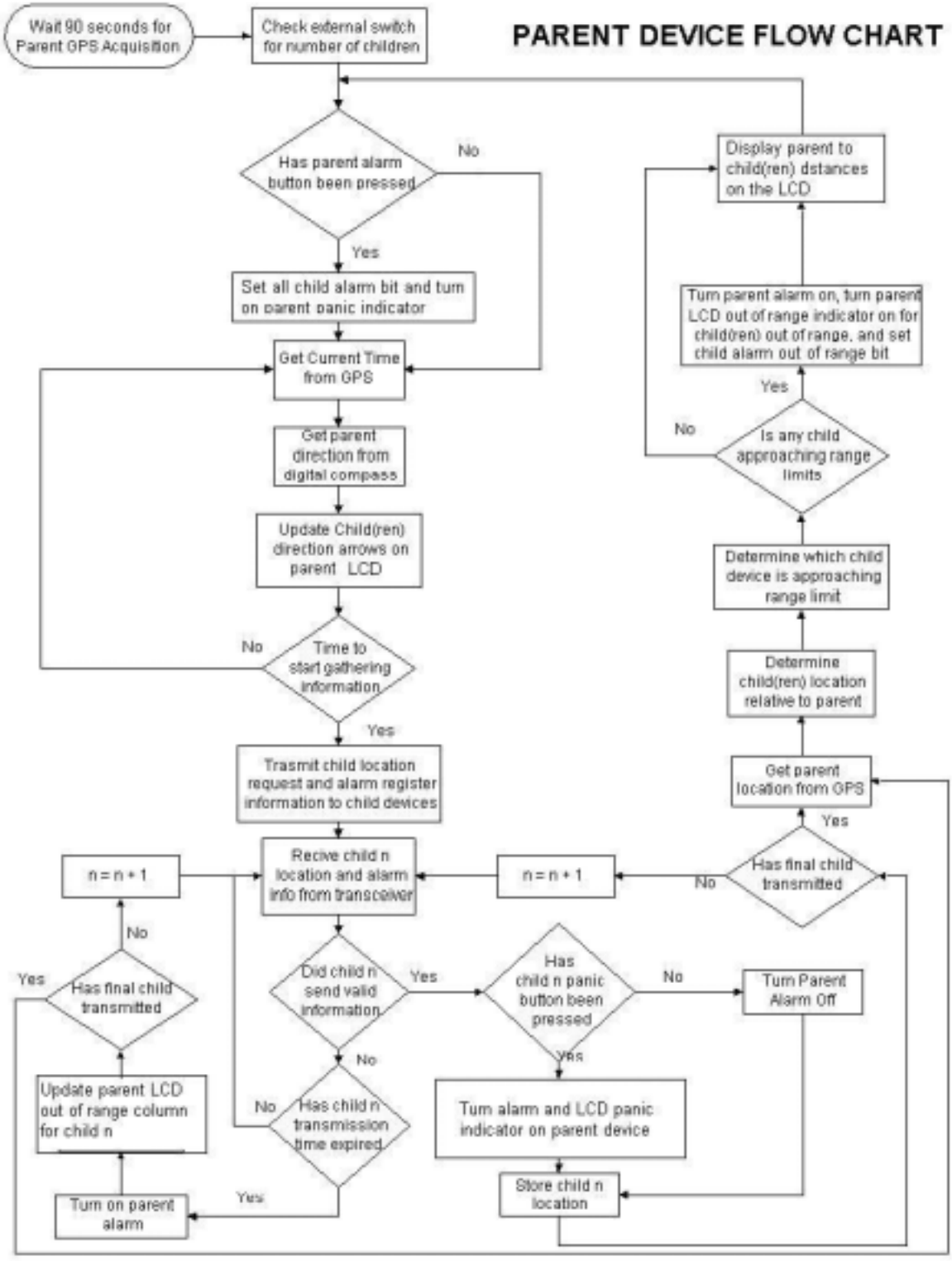
PARENT DEVICE FLOW CHART
Wait 90 seconds for Parent GPS Acquisition
Check external switch for number of children
Has parent alarm button been pressed
No
Yes
Set all child alarm bit and turn on parent panic indicator
Get Current Time from GPS
Get parent direction from digital compass
Update Child(ren) direction arrows on parent LCD
Time to start gathering information
No
Yes
Trasmit child location request and alarm register information to child devices
Recive child n location and alarm info from transceiver
n = n + 1
Did child n send valid information
Yes
Has child n panic button been pressed
No
Turn Parent Alarm Off
Yes
Turn alarm and LCD panic indicator on parent device
Store child n location
No
Has child n transmission time expired
No
Yes
Turn on parent alarm
Update parent LCD out of range column for child n
Has final child transmitted
Yes
No
n = n + 1
Has final child transmitted
No
Yes
Get parent location from GPS
Determine child(ren) location relative to parent
Determine which child device is approaching range limit
Is any child approaching range limits
No
Yes
Turn parent alarm on, turn parent LCD out of range indicator on for child(ren) out of range, and set child alarm out of range bit
Display parent to child(ren) distances on the LCD

Figure 6: Parent Software Flow Chart

Child Device Software Description

Each child device is responsible for determining when the parent device is requesting the child's location and alarm information. After determining that the parent has sent a request, the software must transmit the information to the parent. The transmission information is in the format shown in Appendix C.

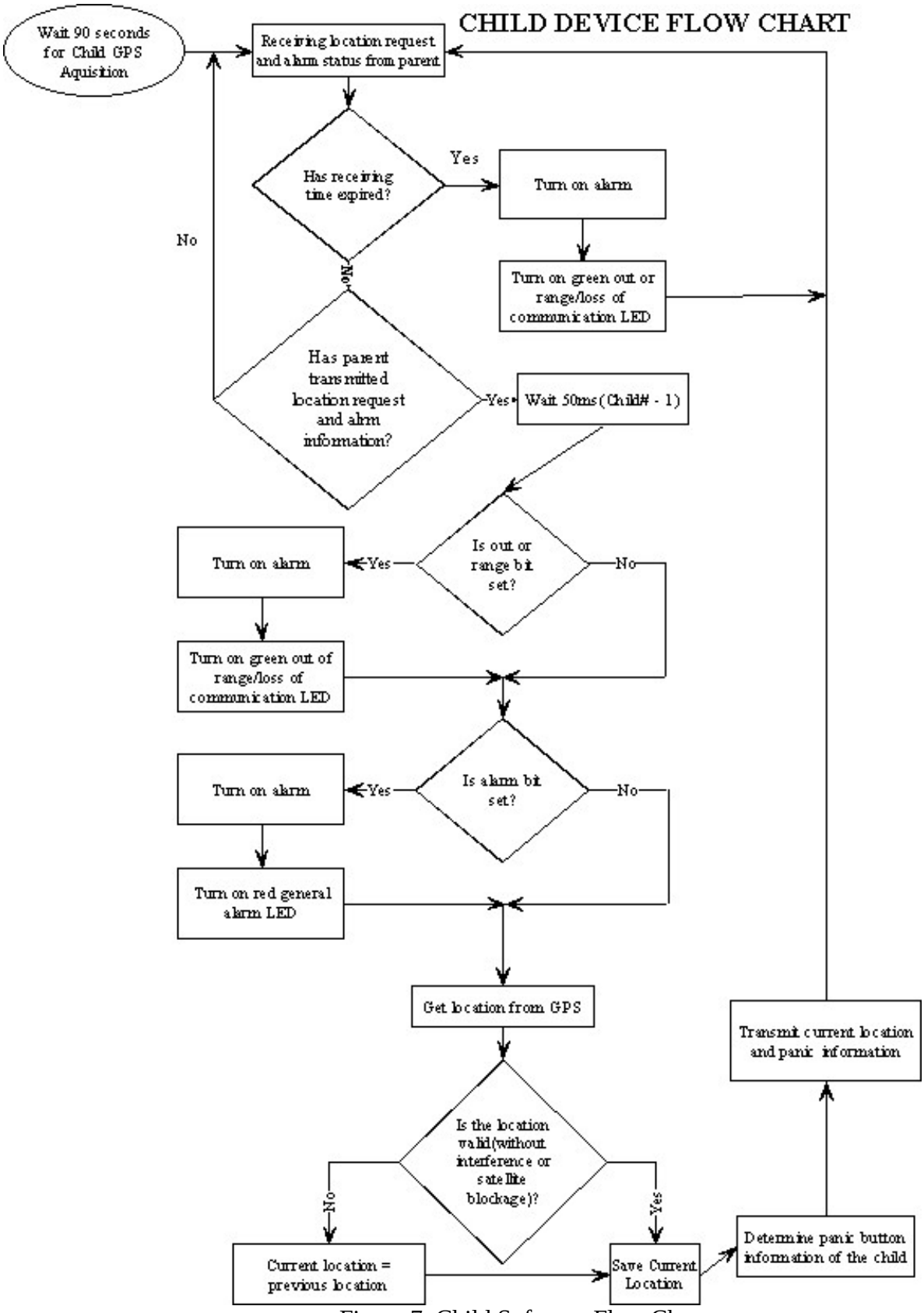
CHILD DEVICE FLOW CHART
Wait 90 seconds for Child GPS Aquisition
Receiving location request and alarm status from parent
Has receiving time expired?
Yes
Turn on alarm
No
Turn on green out or range/loss of communication LED
Has parent transmitted location request and alrm information?
Yes
Wait 50ms(Child# - 1)
No
Is out or range bit set?
Yes
Turn on alarm
No
Turn on green out of range/loss of communication LED
Is alarm bit set?
Yes
Turn on alarm
No
Turn on red general alarm LED
Get location from GPS
Is the location valid(without interference or satellite blockage)?
No
Current location = previous location
Yes
Save Current Location
Determine panic button information of the child
Transmit current location and panic information

Figure 7: Child Software Flow Chart

Parent Device Data Flow Diagrams

Parent DFD 0

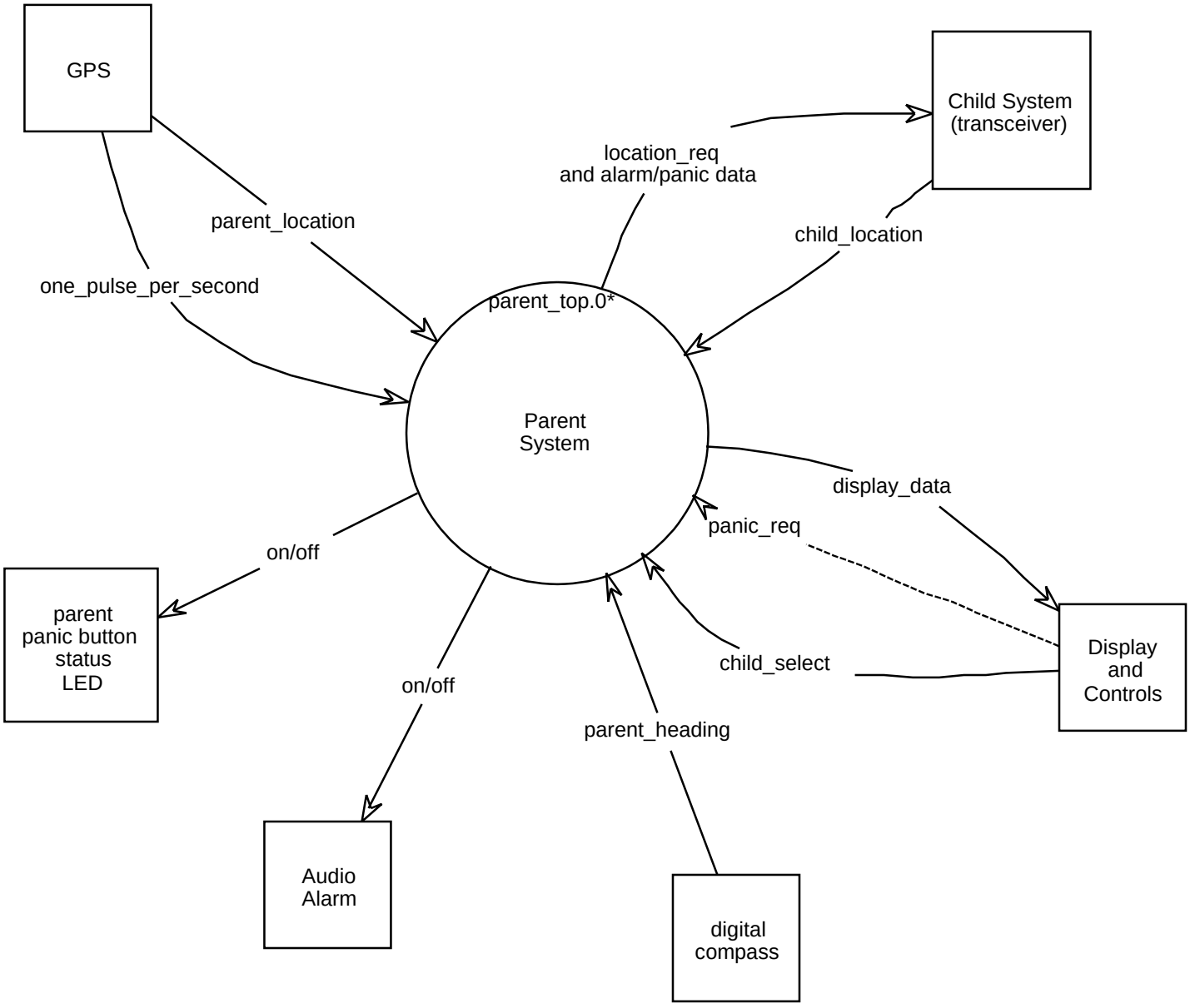

Figure 8: Parent Device DFD 0

Parent Level 1 DFD

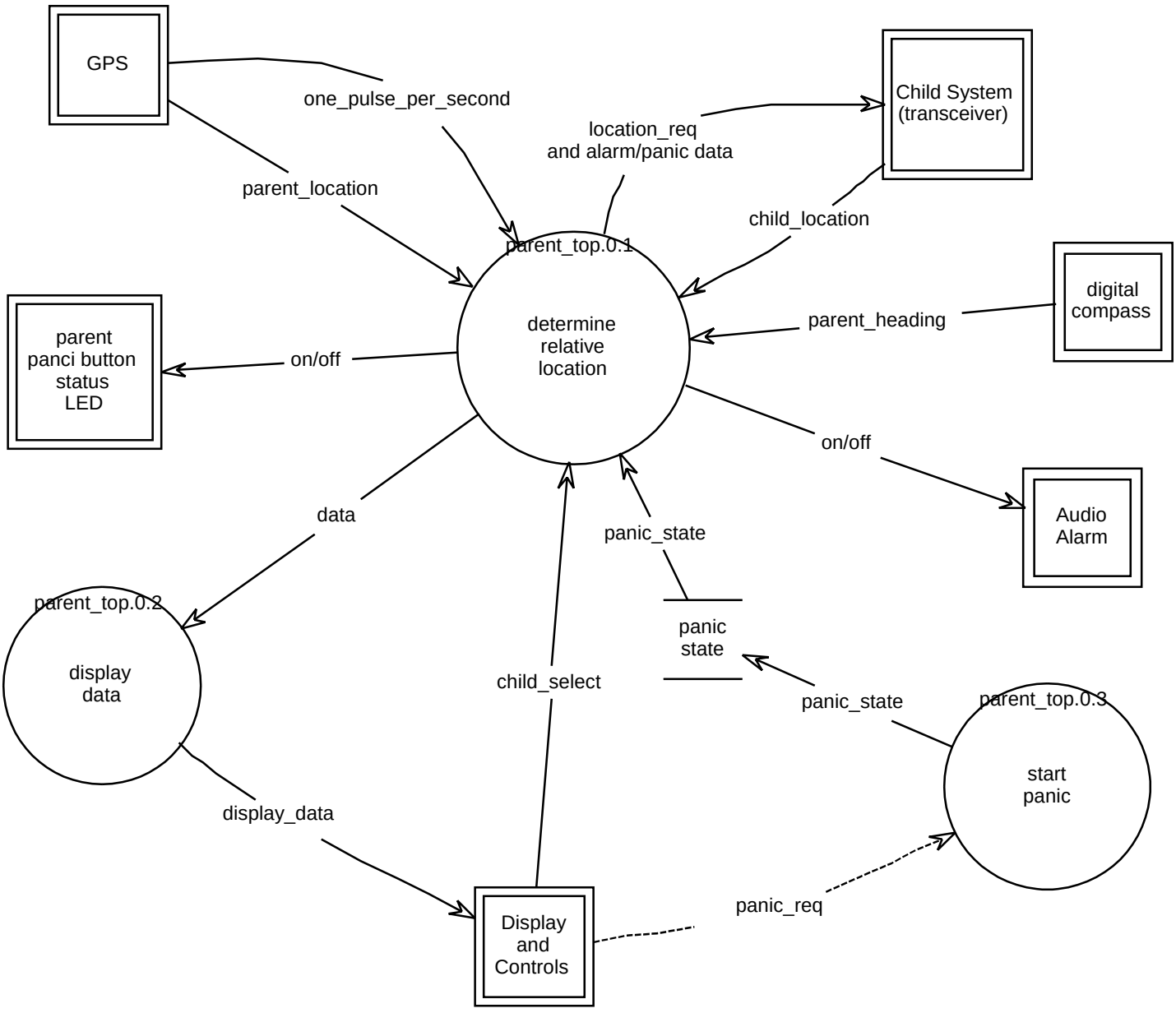

Figure 9: Parent Device DFD 1

Child Device Data Flow Diagrams

Child Level 0 DFD

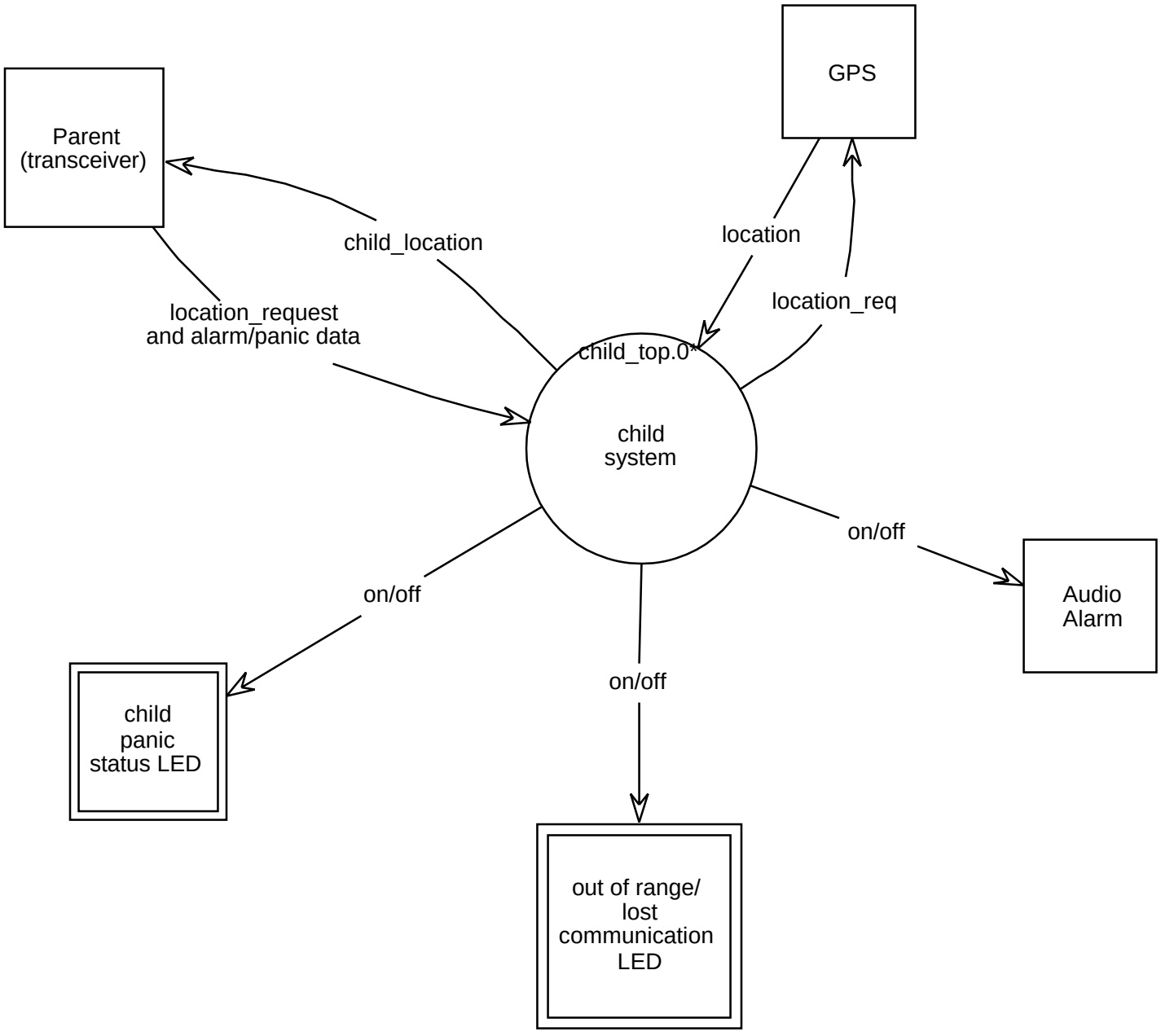

Figure 10: Child Device DFD 0

Child Level 1 DFD

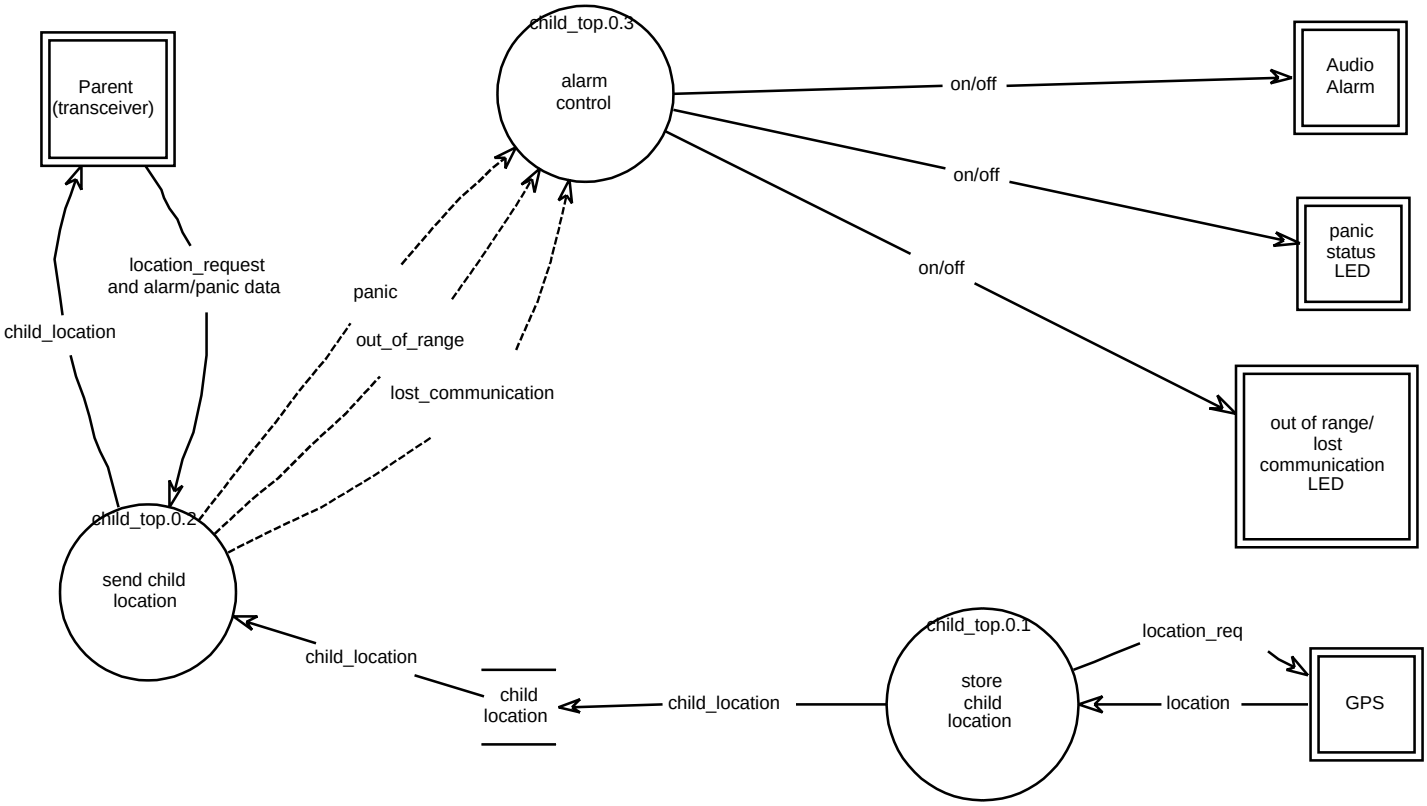

Figure 11: Child Device DFD 1

Organization and Planning

Schedule

Thanksgiving week, the week of 11/19, has purposely been left out of the chart. This will give the team members a chance to catch up due to time estimation errors in the previous weeks.

The project also involves a great deal of programming using the PIC Instruction Set, and every member is responsible for at least one of the software modules. Therefore, all team members must learn and familiarize themselves with the PIC Instruction Set.

Schedule

	TASK	EFFORT					WEEK BEGINNING / WEEK NUMBER														
							8/20	8/27	9/3	9/10	9/17	9/24	10/1	10/8	10/15	10/22	10/29	11/5	11/12	11/26	12/3
		JWD	GLS	JBD	RCB	IRH	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Acquire GPS units, transceivers, and PICs	1	1	1	1	1	5														
2	Select all switches, buttons, alarms, and LEDs	0	0	0	0	9	5														
3	Learn PIC Instruction Set	18	18	18	18	18	42	28	4	12	4										
4	Program PIC software for det. Position	39	0	0	0	0		3	9	9	9	9									
5	Write "main" PIC program for parent	0	0	40	0	0		3	9	9	9	10									
6	Write "main" PIC program for child	0	0	0	35	0		9	13	13											
7	Select and aquire casing and locking system	0	0	0	0	19		10	9												
8	Detailed design USART Contrl ckt	0	19	0	0	0		10	9												
9	Learn GPS Instruction set	10	0	0	0	0			5	5											
10	Build USART Control ckt	0	4	0	0	0				4											
11	Interface PIC with USART control ckt	0	8	0	0	0				8											
12	Configure Parent USART	0	14	0	0	0					7	7									
13	Configure Child USART	0	14	0	0	0					7	7									
14	Debug "main" PIC program child	0	0	0	41	0					9	9	14	9							
15	Assemble LCD ckt	0	0	0	0	6					6										
16	Program LCD test software	0	0	0	0	28						9	9	10							
17	Debug "main" PIC program parent	0	0	43	0	0						5	13	13	9	3					
18	Interface GPS Receiver	8	0	0	0	0							8								
19	Design Power Ckt	0	11	0	0	0							7	4							
20	Assemble and test Power Ckt	0	4	0	0	0								4							
21	Interface Transceiver	0	0	0	4	0								4							
22	Program GPS test software	8	0	0	0	0								8							

24	Program transceivers test software	0	0	0	10	0									6	4						
25	Program alarm test software	0	0	0	0	5									5							
26	Interface PIC and panic button	0	0	0	0	4									4							
27	Design Low Power Indicator	0	9	0	0	0									9							
28	Interface Power ckt w/ components	0	2	0	0	0									2							
29	Integrate Low Power Indicator	0	4	0	0	0									4							
30	Interface Digital compass	0	0	3	0	0									3							
31	Program compass test software	0	0	5	0	0										5						
32	Program panic button software	0	0	0	0	5										5						
33	Construct casing & locking system	0	0	0	0	6										6						
34	Integrate software modules for parent	8	8	8	8	8										15	15	10				
35	Integrate software modules for child	6	6	6	6	6										10	10	10				
36	Test & debug system on breadboards	18	18	18	18	18											33	32	25			
37	Make and assemble printed ckt board	16	0	0	0	0												6	10			
38	Write user manual	5	6	6	5	7													10	10	9	
39	Prepare for design fair	5	8	4	7	6													10	10	10	
	TOTAL	154	154	152	153	153	52	63	58	60	51	56	51	56	54	51	58	58	55	20	19	

Division of responsibility

A conscious effort has been made to assign each member to an area in which they feel comfortable and have some degree of knowledge. Below is a chart that shows how the project has been divided and which group member is responsible for each part.

Members				
Joshua Day	**Gary Shives**	**Jeremy Day**	**Chad Bevins**	**Israel Hall**
JWD	**GLS**	**JBD**	**RCB**	**IRH**
Calculate distance and direction	Build power circuit	Program central parent processing unit	Program central child processing unit	Interface and test of the LCD display
Interface and program GPS unit	Design and interfacing of USART control circuit	Interface, program, and test transceivers	Interface and test of digital compass	Select, interface, and program alarms and buttons for the each device
Design and build printed circuit board	Configure USART			Construct casing and locking of each device

Budget

Child Locator System

Parent Device:		
1. Transceiver		$ 140
2. GPS Receiver		$ 85
3. GPS Receiver Antenna		$ 40
4. LCD Display		$ 20
5. Digital compass		$ 15
6. PIC Microcontroller		$ 10
7. Batteries(4)		$ 10
8. Plastic Case		$ 5

	Parent Device Total:	$ 325
Child Device:		
9. Transceiver		$ 140
10. GPS Receiver		$ 85
11. GPS Receiver Antenna		$ 40
12. PIC Microcontroller		$ 10
13. Batteries(4)		$ 10
14. Plastic Case		$ 5

	Child Device Total:	$ 290
Subtotal (1 Parent + 1 Child)		$ 615
15. Miscellaneous(audio alarm, electronic components, spare parts etc)		$ 100
16. Shipping and Handling Expense		$ 60

		$ 775

Total requested from CSEE Sr Project Account: $775

_____

Signature Date

_____

Project Sponsor Signature Date

_____

Project Monitor Signature Date

Budget Justification

1. The price of Aerocomm's LX2400S-10A transceiver is $140. This includes a microstrip dipole antenna.
2. The price of Motorola's Oncore M12 receiver board is $85.
3. The price of Motorola's active GPS antenna is approximately $20.
4. The approximate price of a four line, twelve character LCD display is approximately $20.
5. The price of a 3-pin digital compass is approximately $15.
6. The price of a 32 pin 18 series PIC chip made by Microchip is $10.
7. The approximate cost of an AA NiCad battery is $2.50. Our design requires eight batteries (four for each unit).
8. Although the price of most plastic cases manufactured by Polycase is approximately one dollar, a conservative estimate of $5 per case was used.
15. The miscellaneous total is an estimate of all other components not mentioned above. This includes an audio alarm, electronic components, and logic gates.

Qualifications

Richard Chad Bevins

264 McCollough Ave. Apt 14 Phone (304) 598-7191
Morgantown, WV 26505 E-mail rbevins@wvu.edu

Objective

I am seeking a summer intern position that will give me experience in my field of study, particularly where I can apply my interests in hardware design and software design, communications, or signal processing.

Education

1997 - 2001 West Virginia University Morgantown, WV
Dual Degree in Computer Engineering and Electrical Engineering
Status: Senior
Overall GPA: 3.98 GPA in Majors: 4.0
Expected Graduation Date: December 2001:

Awards received

President's Dean's List (Spring and Fall '98, Spring and Fall '99, Spring and Fall 2000)
Dean's List (Fall '97)
West Virginia University College of Engineering and Mineral Resources Dean's List
West Virginia University Presidential Award for Excellence in Scholarship
National Dean's List

Computer Skills

Knowledgeable in C, Unix, Ada95, Assembly Language, MatLAB, pSpice, and Microsoft Office

Design Projects

- MPX Operating System - Along with a group, a multiprogramming executive was designed and implemented using C.
- Electronic Padlock – A partner and I designed a circuit that would light a red LED when locked, yellow while entering the code, and green when it was unlocked.
- Game Timer – A partner and I designed an 8-second counter, which illuminated a LED when the counter reached 8, indicating that the time was up.
- Voltage Indicator – A partner and I designed a circuit that would display the voltage of a signal on a bar graph from 0V to 10V in 2V increments.
- VU meter – A partner and I designed a circuit which would display the volume of a person's voice on a bar graph and turn on a light bulb when the volume exceeded a specified dB value.
- Stop Light - A partner and I designed the switching circuit for stoplights for a four-way intersection. This design concentrated mainly on interfacing a M68000 to several LED's that represented the stoplight using an assembly language program.

Professional memberships

IEEE Student Member
Member of National Society of Collegiate Scholars
Golden Key National Honor Society

Work experience

Summer 1998 Ellis Supply Inc. Crown, WV
Manual Labor
I worked in the lumberyard of a locally owned store. From the money that I earned, I paid ~25% of my living expenses during my sophomore year.

Summer 2000 Digital System Resources Fairfax, VA
Summer Intern
While at DSR, I aided in the development of a tool that was to be used by other engineers to test the validity of their design during which I gained some experience with creating GUI's using MOTIF. I also aided in the troubleshooting of circuits that were to be used in the development of one of their current projects.

References

Jonathan Ellis (304)583-9306 work number
Dr. Kathleen Meehan (304)293-0405 x2547
Dr. Roy Nutter (304)293-0405 x2510

JEREMY B. DAY

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Permanent Address:
486 Little Fudge Creek
Barboursville, WV 25504
(304) 743 – 0946

Education

West Virginia University, Morgantown, WV
I am a senior obtaining a Dual Degree in Electrical and Computer Engineering.
Graduating - 12/01
GPA: 3.6

Work Experience

Computer Mapping/Data Entry (Internship) 05/2000 – Current
Allegheny Power

- Circuit Drawings
- Computer Information Updates
- Updated Mapping System

Network Analysis/Computer Programming (Internship) 05/99 – 08/99
Naval Research Laboratory

- Network testing and simulation
- Created and edited software for network analysis

Data Entry/Data Processing 05/98 – 08/98
Rufus & Rufus Accounting

- Word Processing, and Data Entry
- Created Spreadsheets for Clients

Data Entry 08/97 – 05/98
NETCSC (National Environmental Training Center for Small Communities)

- Entered information into database
- Clerical work
- Word Processing

Skills

I have experience programming in C, Ada, Assembly, and MATLAB languages. I have used PSPICE for circuit manipulations, and have experience with HTML code. I am comfortable using Windows, Unix, and Linux. I have experience

using other computer platforms such as Silicon Graphics machines and Sparc stations. I am confident using Microsoft Word, Excel, PowerPoint, and other integrated software packages.

Honors & Activities

IEEE Member
Tau Beta Pi
Eta Kappa Nu
Golden Key National Honor Society
Helvetia Sophomore Honorary (1998 - 1999)
President's List (1997)
Dean's List (1997 - 1999)
Member of an Intramural Football Team (1998 - 2000)
Member of the Huntington Archery Club (1998 - 1999)

References

- Roy Nutter, Advisor/Professor of Electrical and Computer Engineering
  Phone: (304) 293 – 0409 ext. 910 email: rnutter@wvu.edu
- Brian Adamson, Contractor for Naval Research Laboratory/Newlink Technologies
  Phone: (202) 767-2001 email: adamson@itd.nrl.navy.mil

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JOSHUA DAY

OBJECTIVE

To pursue possible electrical and computer engineering opportunities.

EDUCATION

West Virginia University, Morgantown, WV College of Engineering
Electrical and Computer Engineering GPA: 3.6 Graduation Date: December 2001
Senior Status in

EMPLOYMENT HISTORY

03/01 – Current NIOSH Morgantown, WV
Computer Specialist

- Managing and upgrading a multiple processor system (Beowulf Cluster) for biological calculations.

05/00 – 03/01 Allegheny Power White Hall, WV
Engineering Aid

- Assist the Planning Engineer in fusing of circuits, computer aided mapping of facilities, and running electrical analysis of distribution circuits. Responsible for many of the efforts dealing with the reconnection of customers.

05/99 – 08/99 Naval Research Lab Washington, D.C.
Engineering Aid

- Working with a team of engineers developing a new multicast protocol, MDP, for reliable multicast applications. Task included network testing and simulation, development of new network topologies, and writing programs to run simulations and analyze data.

05/98 – 08/98 Rufus and Rufus Accounting FirmHuntington, WV
Engineering Aid

- This job entailed data entry, data processing using Microsoft Office, working as a team, and creating visual presentations for clients.

08/97 – 05/98 College of Engineering-Student Records WVU
Work-Study Program

- Various jobs including filing, copying, and running errands. Required a great deal of responsibility pertaining to student records.

HONORS/ACTIVITIES

WVU Mountaineer Scholar, West Virginia Science and Engineering Scholarship Recipient, Sophomore Helvetia Honorary, Golden Key National Honor Society, Eta Kappa Nu EE Honor Society, Tau Beta Pi, IEEE, President's List, Dean's List, 2-year WVU Intramural Football Team(Captai Huntington Archery Club Member

SKILLS

Computer Languages: Experience with Tcl/Tk, C, MatLab, BASH scripting language, Assembly Language, and Ada

Software: Windows 95 and 98, MS-DOS, UNIX, Linux and Linux based software, NS(network simulator), AutoCad, Microsoft Word, Excel, PowerPoint, Word Perfect, GnuPlot, Nedit

REFERENCES

- Roy Nutter, Advisor/Professor of Electrical and Computer Engineering
  Phone: (304) 293 – 0409 ext. 910
- **Charles Hughes, Systems Planning Engineer for Allegheny Power**
  Phone: (304) 367 – 2249 email: chughe2@alleghenypower.co
- **Joe Macker, Naval Research Laboratory**
  Phone: (202) 767-2001 email: macker@itd.nrl.navy.mil

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Phone: (304) 426 - 4526

OBJECTIVE

My objective in seeking an internship is to gain awareness of and experience in my chosen career field, electrical engineering. My academic emphasis and probable career path is bioengineering. I hope to attain a better understanding of the field as a whole and discover what role I am best suited to play in bioengineering research and development.

EDUCATION

- High School: Magnolia (Matewan) High School, 1997
  Rank: 1 of 52, Valedictorian (4.0 G.P.A.).
  ACT: 31 composite

- College: Currently a senior at **West Virginia University,** Graduation Date: 12/01
  Major: Electrical Engineering; Emphases: 1) Bioengineering and Biometrics
  2) Communications and Signal Processing
  Current Cumulative GPA: 3.15
  Departmental GPA: 3.10

SKILLS

My technical and personal skills include senior-level electrical engineering training, hands-on electrical capabilities, problem solving/analytical skills, well-developed writing and communication abilities, a firm willingness toward teamwork, and an overall strong work ethic. Programming Languages and Software: MatLAB, LabVIEW, Assembly Language (using the Motorola M68000 processor), some C, Microsoft Office, P-Spice, Microcap Schematic Design.

Engineering Course work Completed or In Progress

My current completed or in progress engineering course work includes lecture and lab courses for: Electrical Circuits, Digital and Analog Electronics, Signals and Systems, Electromechanical Energy Conversion and Power Systems, Digital Logic Design, Microprocessor Systems, Engineering Electromagnetics, Bioengineering, Engineering Economics, Biometrics, and Digital Image Processing.

VOLUNTEER EXPERIENCE

1.) Eagles' Nest Program - Worked with elementary level children to serve as role model.
2.) Krazy Klowns - Anti-Drug organization that works with elementary-level children
3.) Teen Institute - Drug-Free organization whose purpose is to set an example for peers
4.) Boys State - Served as Junior Counselor.
5.) D.A.R.E. - Volunteer to instruct elementary children on the risks of drugs.

6.) Special Olympics - Volunteer

EXTRACURRICULAR ACTIVITIES/HOBBIES

1.) Campus Crusade for Christ - Band Leader, Student Target Area Reacher
2.) Music - Vocals, self-taught Guitar and Drums
3.) Outdoor Adventure Club (Outdoor Sports)
4.) Intramural Sports - Basketball, Soccer, Football
5.) West Virginia University Formula Lightning Electric Racing Team
6.) Collegiate 4-H - Service Committee
7.) Astronomy Club

WORK EXPERIENCE

1.) **Rawl Sales and Processing**
i) *Lab Technician (5/97 - 6/97)* - Performed various analyses on coal samples to determine such properties as thermal capability, moisture content, dry ash content, sulfur content, float/sink capabilities, etc.
ii) *General Engineering Assistant (6/97 - 8/97)* - Organized Autocad coal seam maps and other office documents.

2.) **Pilgrim Mining Co., Inc.**
i) *Engineering Assistant (Time-Study)* (5/98 - 6/98) - Performed "time study" on equipment and mining processes to improve production with regards to time and cost efficiency. I was responsible for turning in a daily spreadsheet containing production information.

3.) **Progress Coal Co.**
i) *Electrical Engineering Assistant* (6/98 - 8/98) - Assisted in electrical and mechanical maintenance and repair on mining equipment and facility.
ii) *Electrical Engineering Intern* (5/99 - 8/99, 5/00 - 8/00) - Electrical and Electronic Work: maintenance and repair on Caterpillar, Komatsu, Hitachi, Bucyrus, Jeep, Ford, and Humvee vehicles and equipment; lighting systems; camera system electronics; installed high-voltage power line. Mechanical Work: various mechanical maintenance and repair on assorted equipment and vehicles.

4.) NIOSH
i) *Electrical Engineering/Bioengineering Intern (1/01 – present)* - Department of Engineering Controls & Tech., Musculoskeletal Lab. Designed and implemented hardware and software (LabVIEW) for research study systems

REFERENCES

- Dr. Roy Nutter
  Department: Computer Science and Electrical Engineering
  293-0405 Ext. 2510
  rnutter@wvu.edu
- Dr. Parviz Famouri
  Department: Computer Science and Electrical Engineering
  293 - 0405 Ext. 2530
  pfamouri@wvu.edu
- Dr. Al Stiller
  Department: Chemical Engineering
  293-2111 Ext. 2408

stiller@cemr.wvu.edu

GARY SHIVES II

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(304) 258-3514

EMPLOYMENT OBJECTIVE To obtain a summer position in the field of

Electrical Engineering or Computer Engineering

EDUCATION

West Virginia University, Morgantown, WV
Bachelor of Science in Computer Engineering, Dec. 2001
Bachelor of Science in Electrical Engineering, Dec. 2001
Overall GPA: 3.34

SKILLS

- Computer Languages: C, Ada95, Matlab, and HTML.
- Computer Simulations: P-Spice, Orcad, and Electronic Workbench.
- Presentation Skills: Microsoft Word and Power Point.

WORK EXPERIENCE

- Software/Systems Engineer
  Digital Systems Resources (June 2000 – August 2000)
  Worked on some projects using Matlab and C programming languages
- Wise Library Employee
  West Virginia University (August 1998 – December 1999)
  Worked in acquisition department processing books to be shelved and helped with deliveries
- Bus Person/ Waiter/ Setup Person/ Dish Washer/ Cook/ Prep Kitchen
  The Country Inn, Berkeley Springs, WV (July 1996 – Present)
  Promoted to each position with raise after successfully performing in prior position
- Maintenance
  Frank Subasic, Berkeley Springs, WV (September 1995 –

September 1996)
Helped homeowner build residence by preparing the interior to be painted and helped to paint the interior

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HONORS AND ACTIVITIES Institute of Electrical and Electronics Engineers (IEEE)

REFERENCES Available upon request

Appendix A: Calculation Estimates

This calculation estimate will show the approximation of the distance from the parent device to the child device and the relative direction from the parent to the child.

The way we plan to determine the distance and direction is by using the GPS coordinates gathered from both the parent and the child devices. These coordinates will be outputted from the GPS receivers in a binary representation of a format know as degrees, minutes, and seconds. In order for us to perform our required calculations we need to convert this format into decimal degrees by using the equation:

$$DD°(\text{decimal degrees}) = D° + M' / 60 + S'' / 3600$$

The GPS coordinates are determined by latitude and longitude positions. The prime meridian connects the north and south poles at Greenwich, England just outside London. This point is 0° longitude. The 0° latitude mark starts at the equator.

A few conversions for coordinates to other types of measurements are listed in Table R-1.

Table R-1

1 mile	52.631 seconds	5280 feet
1 nautical mile*		1 minute
1 degree	3600 secs/degree	100.32 ft/sec

* Great Circle Method

The exact method for calculating the distance and direction were gathered from Circuit Cellar's WebPage:

$$\text{Distance} = \cos^{-1}(\sin(lat1)\sin(lat2) + \cos(lat1)\cos(lat2)\cos(lon1-lon2))$$

$$\text{Course} = \arctan^{2}(\sin(lon1-lon2)\cos(lat1)\cos(lat2)\sin(lat2) - \sin(lat1)\cos(lat2)\cos(lon1-lon2))$$

Our device is only designed to work for a range of under one-mile. These equations above can be simplified and approximated for such a small distance. The reason for approximation of direction and distance is processor time and processor resources.

The method of approximating the distance is to first convert the coordinates into decimal degrees. Then using the third row in Table R-1, convert the degrees into feet. Noting that all the latitude and longitude coordinates are converted into feet, the approximated equation is

$$\text{Distance}_{approx} = \text{sqrt}((lat1-lat2)^2 + (lon1-lon2)^2)$$

The display we will be using will only be capable of displaying a maximum of eight directions. Because of this we will be approximating the direction of the child. This can be done by breaking the eight directions into eight quadrants. Each quadrant will

represent a certain distance and direction (north, south, east, and west) relative to current position of the parent device. By comparing the child's coordinates to the parent's coordinates, a particular quadrant will be selected for display.

An example of the distance approximation can be seen in Ex R-1.

Ex R-1.

Coordinate 1: 75° 0' 0'' N } Person 1
Coordinate 2: 65° 0' 0" W }

Coordinate 3: 74° 59' 08" N } Person2
Coordinate 4: 64° 59' 59" W }

Distance = **0.997 miles** (according to the formula fcc.gov)

$Distance_{approx}$ = sqrt(((75-74.985) *3600*100.32)^2 + ((65-54.99972) *3600*100.32)^2) = 5217.5045264 ft = 0.**988183 miles**

As seen in Ex R-1, the approximation method is very close to the exact distance calculated using the Great Circle Method. Given the error in the GPS units and the possibility for error in the microprocessor and transmission, this is a pretty good approximation.

Appendix B: Supporting Information

Transmission timing

A major goal in creating a functional child locating system is the ability to have numerous systems working at once. This can be accomplished by using a timing sequence. In order to use a timing sequence there must be a common clock. This design uses a GPS for both child and parent devices. This is very convenient, because all GPS's have the same time with accuracy to the second.

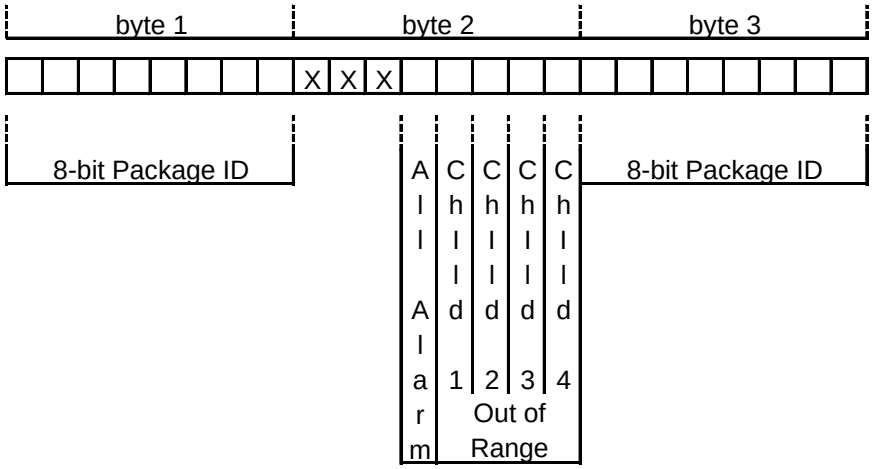
Each parent device is configured to transmit on a different second interval. The parent transmits a request to its children. Each child device response back to the parent before the next parent transmits a request. Transmissions for parent and child devices take a maximum amount of 20 milliseconds each. If a parent has 4 children, transmission time would amount to 100 milliseconds. This is well under the 1 second time requirement.

Example:
Parent 1 transmits every 10 seconds starting with __:__:00
Parent 2 transmits every 10 seconds starting with __:__:01
Parent 3 transmits every 10 seconds starting with __:__:02
Parent 4 transmits every 10 seconds starting with __:__:03
Parent 5 transmits every 10 seconds starting with __:__:04
Parent 6 transmits every 10 seconds starting with __:__:05
Parent 7 transmits every 10 seconds starting with __:__:06
Parent 8 transmits every 10 seconds starting with __:__:07
Parent 9 transmits every 10 seconds starting with __:__:08
Parent 10 transmits every 10 seconds starting with __:__:09

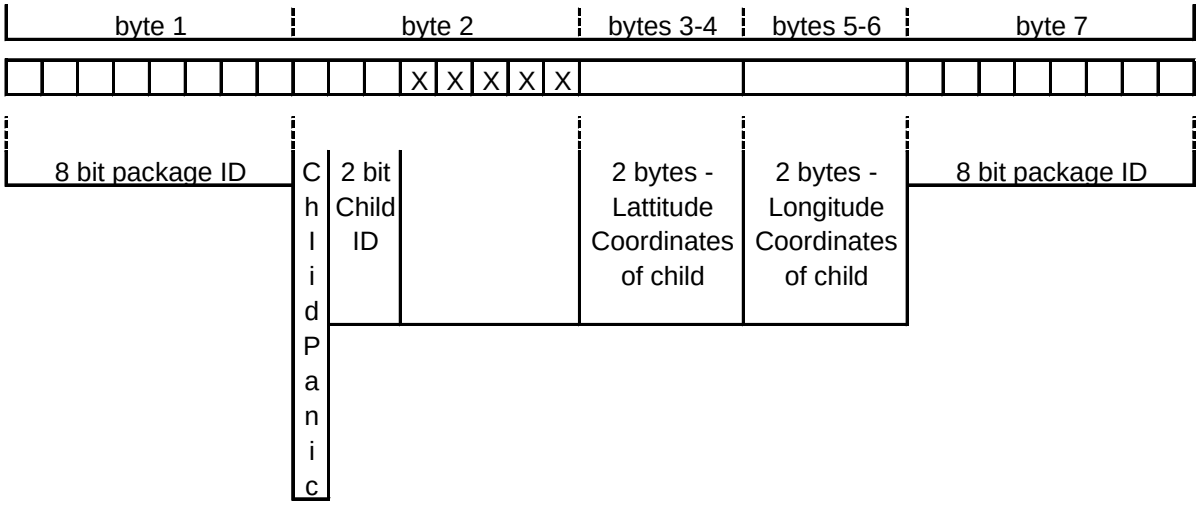
Parent 1 will transmit at 12:01:00; parent 2 will transmit at 12:01:01; parent 3 will transmit at 12:01:02, etc. This process continues until 12:01:09 is reached. Then it would start all over for 12:01:10, and so on. Using this technique only 10 children can operate on one frequency, but the transceiver can be configured to operate on up to 66 different frequencies. In theory there could be up to 660 child locator systems operating in one environment.

Appendix C: Transmission Sequence

Communication from Parent to Child Device(s)



Communication from Child Device(s) to Parent Device



Appendix D: Wiring Diagram

Figure 12: Parent Device Wiring Diagram

Figure 13: Child Device Wiring Diagram

Appendix E: References

1. http://www.babysupermall.com/main/products/fpr/fpr71573.html
2. http://www.mrgadget.com/html/599/gda518.html
3. http://www.spectrum.ieee.org/spectrum/feb01/departments/tool.html
4. http://www.wherifywireless.com/prod_watches.htm
5. http://www.spectrum.ieee.org/spectrum/feb01/departments/toolf2.html